

What is the most suitable option for managing burnt forest catchments? A modelling approach to evaluate different post-fire management scenarios

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Objectives :

The objective of this work is to present consistent information on the potential impacts on the stream water of three post-fire land management scenarios (bench terracing, mulching, and the spontaneous recovery of the vegetation).

To achieve this goal the Soil and Water Assessment Tool (SWAT) was calibrated for the three scenarios and validate for the terracing period. After it, the comparison between the three scenarios was implemented to study the short-to-medium term impacts on water availability and quality.

Methodology:

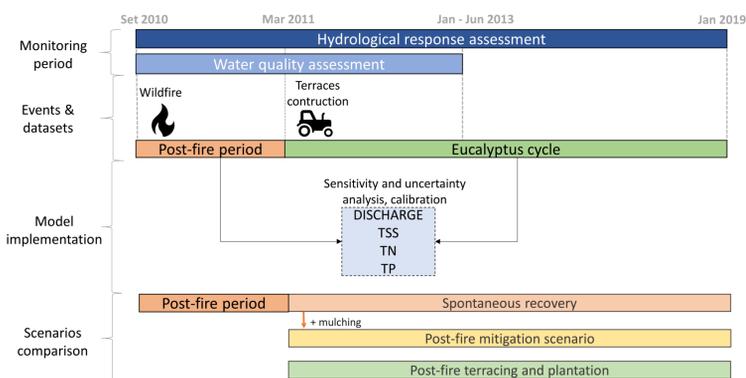


Figure 2 - Model conceptual framework.

• Study area

The study was conducted in Ermida catchment in the central region of continental Portugal (Figure 1), which was entirely burned by a wildfire in July 2010. Seven months after the fire, terraces for eucalyptus plantation were implemented.

• Post-fire management scenarios

- Spontaneous recovery (SR) with a 3 years timestep to consider the gradual restoration of the vegetation and the soil properties.
- Mulching (M) application as a mitigation treatment to the areas affected by a high and moderate severity fire.
- Terracing (T) and first eucalyptus cycle.

• Model calibration

The model was separately calibrated for the post-fire period (November 2010 – March 2011) and for the post-terracing period (March 2011 – December 2018). Besides that, sensitivity and uncertainty analysis were conducted using Rstudio. Mulch was calibrated at plot scale comparing the results with field data.

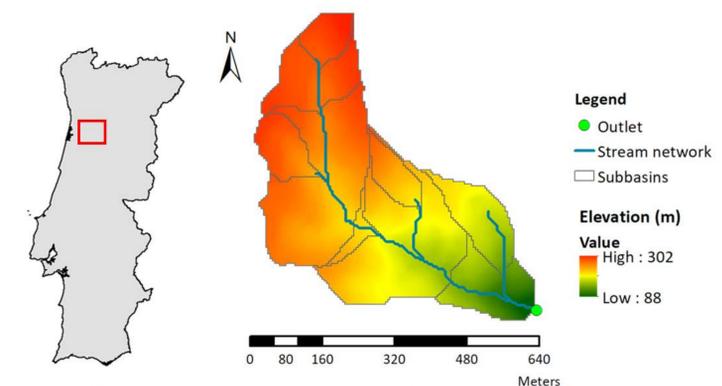


Figure 1 - Study area location and dem of the catchment.

Results:

- **Higher uncertainty** was reported for the post-fire period, mainly for the water quality variables.
- **Calibration** resulted satisfactorily both at daily and at monthly scale.
- **M** was satisfactorily integrated into the SWAT model, reflecting the measurements of Prats et. al (2016).
- **SR** had the greatest impacts on the sediment transport and the TN exports, reaching significantly higher values than the other scenarios.
- **M** scenario revealed the smaller impacts on the water quality (Figure 3).
- **T** reported the highest values of total flow and TP export, while TN export resulted similar to the value reported for the M scenario.

Conclusions:

- Satisfactory model adaptation to post-fire conditions.
- Novelty in simulating the impacts of terraces for eucalyptus production on the hydrological response at catchment scale.
- Wildfires impacts on the water quality persisted along the 8 years of the simulations.
- M and T scenarios reduced the sediment transported in the stream.
- Alarming TP exports were reported in the T scenario.

References:

Basso M.; Serpa D.; Martins M.A.S.; Keizer J.J.; Vieira D.C., -. What is the most suitable option for managing burnt forest catchments? A modelling approach to evaluate different post-fire management scenarios. *ongoing*.

Prats S.A., Wagenbrenner J.W., Martins M.A.S., Malvar M.C., Keizer J.J., 2016. Mid-term and scaling effects of forest residue mulching on post-fire runoff and soil erosion. *Science of the Total Environment* 573, 1242–1254. [10.1016/j.scitotenv.2016.04.064](https://doi.org/10.1016/j.scitotenv.2016.04.064)

Acknowledgments:

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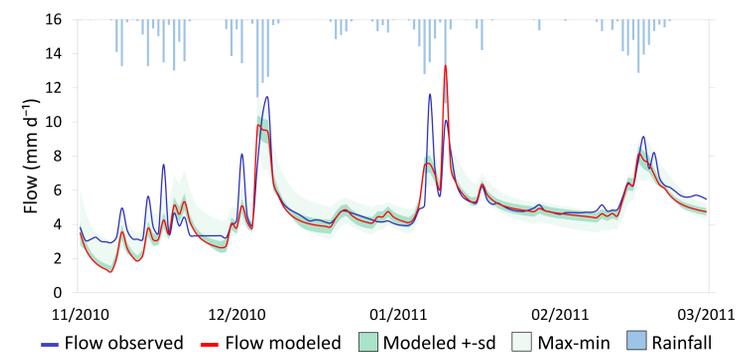


Figure 3 – Daily flow comparison for the post-fire period.

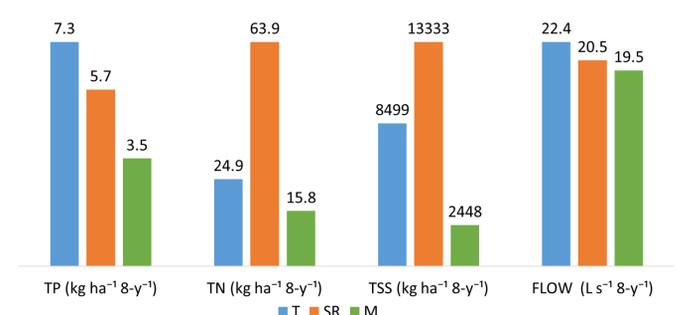


Figure 4 – 8 years comparison for the different parameters understudied. The total 8-years exports are depicted. The results were scaled to a 0-1 scale for a better representation.